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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/753,269      | 01/08/2004  | Yuchun Wang          | 100213              | 6571             |

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EXAMINER

LE, THAO P

ART UNIT PAPER NUMBER

2818

DATE MAILED: 04/04/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

H.A

|                              |                                      |                                     |  |
|------------------------------|--------------------------------------|-------------------------------------|--|
| <b>Office Action Summary</b> | <b>Application No.</b><br>10/753,269 | <b>Applicant(s)</b><br>WANG, YUCHUN |  |
|                              | <b>Examiner</b><br>Thao P. Le        | <b>Art Unit</b><br>2818             |  |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

#### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 08 January 2004.
- 2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 1-28 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-28 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 08 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |   |   |
|---|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)   | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>01/08/04</u> . | 6) <input type="checkbox"/> Other: _____  |

DETAILED ACTION

***Information Disclosure Statement***

1. Information Disclosure Statement (IDS) filed on **01/08/04** and made of record.

The references cited on the PTOL 1449 form have been considered.

***Claim Rejections - 35 USC § 102***

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless --

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

3. **Claims 1-3, 5-7, 22-23, 27-28 are rejected under 35 USC 102 (a) as being anticipated by Inoue et al., U.S. Pub. No. 2003/0075808.**

Regarding claim 1, Inoue et al. discloses a method of modifying a substrate comprising the steps of (See Figs. 1-57d and pages 1-25): providing a substrate comprising a base and a first metal deposited on at least a portion of the base (7, Fig. 57B); applying chemical-mechanical polishing process to remove portion of the first metal (Fig. 57C), the chemical-mechanical polishing (CMP) process inherently includes the required steps of providing a polishing pad, providing a chemical-mechanical polishing composition, contacting the pad to the substrate and moving the pad relative to the substrate to polish the substrate; depositing a second metal on the substrate (20, Fig. 57D). Inoue et al. doesn't disclose the rate of deposition of the second metal is

about 400 A per minute or more. However, it is inherent that the rate of the deposition using electroplating process is a direct function of current-density and the current delivered to the surface is directly proportional to the quantity of metal deposited and the mass deposited can be controlled through plating current and time, therefore, the deposition rate depends on current and time. It is also inherent that the deposition rate of electroplating is high, about 400-1000 nm/minute which is higher than 400 A/minute.

Regarding claim 2, Inoue et al. discloses wherein the deposition of the second metal is electroless (electroplating) deposition.

Regarding claims 3, 5, 6, Inoue et al. discloses wherein the second metal (20, Cu) is the same as the first metal (7, Cu) (paragraph 0274-0277).

Regarding claim 7, Inoue et al. discloses wherein the CMP process is continued until dishing occurs with respect to the first metal (Fig. 57C).

Regarding claims 22-23, Inoue et al. discloses the CMP is electrochemical-mechanical polishing composition.

Regarding claims 27-28, Inoue et al. discloses the temperature of electroless deposition is performed in the range of 20-90 °C which covers the range cited in claims 27-28 (paragraph 0273).

4. Reference cited in form 1449 (JP-11-231925) also discloses the limitations of claims 1-3, 5-7 (under 102 (a)): providing a substrate comprising a base and a first metal 20a deposited on the base, providing CMP process to remove portion of the first metal (Fig. 1B), depositing a second metal on the substrate (24, Fig. 1D), wherein the

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first and second metal are the same (Cu) and the deposition of the second metal is electroless deposition.

### **Claim Rejections - 35 USC § 103**

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 4, 8-21, 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Inoue et al, in view of WO patent No. 02/23613 (submitted by applicant as prior art).

Regarding claim 4, Inoue et al. discloses the use of CMP process to polish the first metal in the trench but doesn't mention the first and second CMP compositions are used in CMP process. WO patent No. 02/23613, however, discloses the use of first and second CMP compositions in the CMP process of polishing the metal in the trench (Pages 1-5). it would have been obvious to one skilled in the art at the time of the invention to use the first and second CMP compositions as disclosed in WO patent No. 02/23613 because the first CMP composition is used to remove the metal above the

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trench to a level of underlying barrier film and then using the second CMP composition to remove the barrier layer to a level of underlying interlayer dielectric as shown in Figs. 57A-57D of Inoue et al. In addition, it would have been obvious to one having ordinary skill in the art that repeating the same step or splitting one into two steps where the processes are substantially identical or equivalent in terms of function, manner and result, was held to not patentably distinguish the processes. Ex party Rubin 128 USPQ 440 (PTO BdPatApp 1959).

Regarding claims 8-9, Inoue et al. and WO patent No. 02/23613 disclose the polishing process is continued until the excess metal outside the trench is gone as the same as taught in present invention but fail to disclose the thickness of the metal to be dished is about 400 or 1000 Å. It would have been obvious to one having ordinary skill in the art at the time the invention was made that the thickness of the metal to be dished depends on the thickness of the excess metal formed on the substrate and outside the trench.

Regarding claim 10, both Inoue et al. and WO patent No. 02/23613 discloses the substrate comprises silicon or an interlevel dielectric.

Regarding claims 12-13, Inoue et al. discloses wherein the electroless deposition comprises the application of a deposition solution to the substrate and the solution comprises a reducing agent, a metal complexing agent, a metal ion, and a pH reagent (page 22).

Regarding claim 14, Inoue et al. discloses the metal complexing agent is a carboxylic acid (para 0270).

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Regarding claim 15, Inoue et al. discloses wherein the deposition solution comprises EDTA, KOH etc.. (page 22).

Regarding claim 16, Inoue et al. discloses the pH is in the range of 5-14 which is in the range that cited in claim 16.

Regarding claims 24-26, Inoue et al. discloses the substrate comprises a layer of a barrier metal that is on the base and partially exposed on the surface of the base and partially disposed between the first metal and the base (Fig. 57A) and the barrier material comprising Ta, TaN, Ti, Ti alloy etc... and wherein the polishing of the substrate remove the second metal and barrier material exposed on the base that is not between the base and first metal (inside the trench).

Regarding claims 11, 17-19, WO patent No. 02/23613 discloses the electroless deposition is performed for about 3 minutes and the growth rate is about 3A/sec that fall into the ranges cited in claims 17-19. Regarding claims 11, and 17-19, it is well known that the selection of such parameters such as **energy, concentration, temperature, time, molar fraction, depth, thickness, rate, etc.**, would have been obvious and involve routine optimization which has been held to be within the level of ordinary skill in the art. "Normally, it is to be expected that a change in **energy, concentration, temperature, time, molar fraction, depth, thickness, rate, etc.**, or in combination of the parameters would be an unpatentable modification. Under some circumstances, however, changes such as these may impart patentability to a process if the particular ranges claimed produce a new and unexpected result which is different in kind and not merely degree from the results of the prior art ... such ranges are termed "critical ranges and the applicant has the burden of proving such criticality.... More particularly, where the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." *In re Aller* 105 USPQ233, 255 (CCPA 1955). See also *In re Waite* 77 USPQ 586 (CCPA 1948); *In re Scherl* 70 USPQ 204 (CCPA 1946); *In re Irmischer* 66 USPQ 314 (CCPA 1945); *In re Norman* 66 USPQ 308 (CCPA 1945); *In re Swenson* 56 USPQ 372 (CCPA 1942); *In re Sola* 25 USPQ 433 (CCPA 1935); *In re Dreyfus* 24 USPQ 52 (CCPA 1934).

Regarding claims 20-21, both Inoue et al. and WO patent No. 02/23613 disclose the deposition of the second metal onto the substrate is performed while the polishing pad is contacting at least a portion of the substrate or moving relative to the substrate.



7. When responding to the office action, Applicants' are advice to provide the examiner with the line numbers and page numbers in the application and/or references cited to assist the examiner to locate the appropriate paragraphs.

A shortened statutory period for response to this action is set to expire 3 (three) months and 0 (zero) day from the day of this letter. Failure to respond within the period for response will cause the application to become abandoned (see M.P.E.P 710.02(b)).

### ***Conclusion***

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Thao P. Le whose telephone number is 571-272-1785. The examiner can normally be reached on M-T (7-6).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David Nelms can be reached on 571-272-1787. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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A handwritten signature in black ink, appearing to read 'Thao P. Le'. The signature is fluid and cursive, with the first letter 'T' being large and stylized.

Thao P. Le  
Examiner  
Art Unit 2818  
March 30, 2005.